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(54)【発明の名称】　触媒用断熱材

(57)【要約】

【目的】　有機分を殆ど用いることなく、断熱壁の高温側には、極めて熱伝導率が低く、耐久性に優れた断熱材を配し、低温側には、低温での断熱性と組み付け性及び復元性を備えた、無機繊維質断熱材を用いた多層構造により、断熱性、組み付け性、耐久性に優れた自動車排気ガス浄化触媒用断熱材を提供することにある。

【構成】　断熱壁の構成に於いて、その高温側に平均繊維径が１０μｍ以下であるセラミック系無機繊維を１～５０ｗｔ％、平均屈折率が１．４以上であり、かつその平均粒子径が１０μｍ以下である無機粉体１種または２種以上を４０～９８ｗｔ％、無機結合材を１～２０ｗｔ％の割合で配合してなり、嵩密度０．３０～０．５０ｇ／ｃｍ^3 を有することを特徴とする断熱材を配し、かつ前記断熱壁の構成の低温側に主として無機繊維からなる、常温に於ける５０％圧縮荷重が１Ｋｇｆ／ｃｍ^2 以下の断熱材を１種または２種以上組み合わせた多層構造からなる自動車排気ガス浄化触媒用断熱材。

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【特許請求の範囲】

【請求項1】　断熱壁の構成に於いて、その高温側に平均繊維径が10μm以下であるセラミック系無機繊維を1～50wt%、平均屈折率が1．4以上でありかつその平均粒子径が10μm以下である無機粉体1種または2種以上を40～98wt%、無機結合材を1～20wt%の割合で配合してなり、嵩密度0．30～0．50g／cm³ を有することを特徴とする断熱材を配し、かつ前記断熱壁の構成の低温側に主として無機繊維からなる、常温に於ける50%圧縮荷重が1Kgf／cm² 以下の断熱材を1種または2種以上組み合わせた多層構造からなる自動車排気ガス浄化触媒用断熱材。

【請求項2】　シリカ－アルミナ繊維、アルミナ繊維、シリカ繊維、チタン酸カリウムウィスカー等各種ウィスカーを含む、断熱壁の構成に於いてその高温側に用いられる請求項1記載のセラミック系無機繊維。

【請求項3】　固体熱伝導率が室温時に0．06cal／cm．sec．deg以下である請求項1記載の無機粉体。

【請求項4】　断熱材の用途が自動車排気ガス浄化用のセラミックまたはメタル触媒コンバーターの断熱及び保温を目的とした請求項1記載の自動車排気ガス浄化触媒用断熱材。

【発明の詳細な説明】

【0001】

【従来の技術】従来、自動車排気ガス浄化触媒に仕様される断熱材として、例えばガラスウールマットやシリカアルミナ繊維からなるセラミックファイバーブランケット（例えばイビデン株式会社製：商品名イビウール・ソリッドブランケット）等の不織布を展開形状に打ち抜き加工したものを、触媒担体とその外筒となる金属ケースとの間に圧縮装置されたものが使用されている。

【0002】近年、自動車燃費の改善の為排気ガス温度は、従来に比較し上昇しつつあり、更には排気ガス規制強化の動きの中から、より排気ガス浄化触媒の浄化効率の高いものが求められつつあり、排気ガス浄化触媒の近傍に於いては、その反応熱により排気ガス温度より更に温度が高くなっている。ところが、前記ガラスウールマットでは、その耐熱温度が600～800℃迄しかない為、上記排気ガスの高温化により、溶損や著しい性能劣化が生じるという問題点があった。更に、前記シリカアルミナ繊維からなるセラミックアフイバーブランケットは耐熱温度が1260℃と優れている為、ガラスウールマットのような熱劣化は生じないものの、自動車の排気系部品というごく限られたスペースの中に於いては、上記排気ガス温度の高温化に対して単純に断熱厚みを増やす事ができず、排気ガス浄化触媒の外筒温度が高くなってしまい、周辺の電子部品やゴム系のホース類を熱害によって損傷させるのみならず、走行後の停車時に自動車の車体下部に枯れ草や段ボール等の可燃物があった場

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合、熱害により火災が生じる等の不安があるという問題点があった。

【0003】これに対し、本発明者らは、特願平4－22119号に於いて、セラミック系無機繊維を5～50wt%、無機粉体を50～95wt%必要に応じて無機結合材を3～5wt%及び有機弾性物質を3～10wt%の割合で配合してなり、嵩密度0．35～0．45g／cm³ を有することを特徴とすることにより、従来の断熱材よりも飛躍的に断熱性及び耐熱性を改善させた断熱材を発明した。

【0004】

【発明が解決しようとする課題】ところが、上記従来の断熱材は、自動車排気ガス浄化触媒に組みつける際の作業性改善の為に有機弾性物質を3～10wt%の割合で含む。この断熱材使用時に（自動車のエンジンを実際にかけた時）有機弾性物質が除々に焼失し、燃焼ガスによる悪臭がたちこめるばかりでなく断熱材使用時、加熱と同時に有機弾性物質が焼失し、焼失後有機弾性物質の存在した部分は、空隙となってしまう為、特に350℃以上の温度下では輻射熱の散乱、遮断効果が低下し、断熱性が不十分であるという結論に達した。そこで、本発明の目的は、使用部位の形状に応じて断熱材が成形でき、しかも従来品より断熱性を向上させ、さらに圧縮組付性を改善させた自動車排気ガス浄化触媒用断熱材を提供することにある。

【0005】

【課題を解決するための手段及び作用】断熱壁の構成に於いて、その高温側に平均繊維径が10μm以下であるセラミック系無機繊維を1～50wt%、平均屈折率が1．4以上でありかつその平均粒子径が10μm以下である無機粉体1種または2種以上を40～98wt%、無機結合材を1～20wt%の割合で配合してなり、嵩密度0．30～0．50g／cm³ を有することを特徴とする断熱材を配し、かつ前記断熱壁の構成の低温側に主として無機繊維からなる、常温に於ける50%圧縮荷重が1Kgf／cm² 以下の断熱材を1種または2種以上組み合わせた多層構造からなる自動車排気ガス浄化触媒用断熱材。

【0006】

【作用】次に本発明の構成を詳細に説明する。まず、断熱壁の構成に於いて、その高温側に配する断熱材について説明する。セラミック系無機繊維としてはシリカ－アルミナ繊維、アルミナ繊維、シリカ繊維、SiCウィスカー及びチタン酸カリウムウィスカー等各種ウィスカーが使用できる。かかるセラミック系無機繊維の配合量は1～50wt%の範囲であり、この割合が1wt%未満では、繊維の補強効果が得られず著しく取り扱い性、機械的強度が低下してしまう。

【0007】一方、50wt%を超えると無機粉体の添加量が少なくなるため対流伝熱、分子伝熱、輻射伝導等

が増大するので断熱特性が著しく低下してしまう。また、前記無機繊維の平均繊維径は10μm以下であることが必要である。なぜなら、一般に無機繊維は硬直である為、平均繊維径が10μmより大きいと、繊維間の空隙が大きくなり、得られた断熱材中に粗大な空隙が生じ、輻射熱を伝播しやすくなってしまうからである。

【0008】本発明に於いては以下に示す条件に適合する無機粉体を一種または二種類以上選択して使用する。

（1）　平均屈折率が1．4以上である。

（2）　平均粒子径が10μm以下である。

（3）　固体熱伝導率が室温時に0．06cal／cm．sec．deg以下である

平均屈折率が1．4以上の粉体としては、TiO_2 、$BaTiO_3$ 、PbS等が挙げられるが、このグループの無機粉体は、輻射熱の散乱材として極めて重要な役割を有しており、輻射熱をより効果的に散乱させるためには、できるかぎり屈折率が大きく、しかも波長10μm以上の光に対する反射率が70%以上であるピークを有している無機粉体を用いることが望ましい。従って、本発明に於いては、ルチル型構造のTiO_2 を用いることにした。

【0009】又、本発明に於いて用いる無機粉体は平均粒径が10μm以下の範囲内であり、しかも各粉体が有する固体熱伝導率は、0．06cal／cm．sec．deg（at室温）以下であるような物に限定している。平均粒径が、10μm以上の粉体を用いると、断熱材中に生じる空孔が極めて大きくなってしまうため、対流及び分子伝熱が増大し、熱伝導率が悪化してしまう。それから、固体熱伝導率についても0．06cal／cm．sec．deg（at室温）以上の粉体を用いると、断熱材中に於いて固体伝熱が支配的になり、熱伝導率が悪化してしまう。従って、本発明に於いては前述に記載した3つの条件に適合した一種または二種類の無機粉体を使用し、その配合割合は40～98wt%の範囲とする。無機粉体の配合割合が40wt%以下では、屈折率大の粉体量が少なくなるため、輻射熱の散乱が不十分となり、300℃以上の高温下での熱伝導率が悪化してしまう。また、98wt%以上では、熱伝導率の面では有利であるが、セラミック系無機繊維等の配合割合が2wt%未満となってしまい、強度が著しく低下してしまう。

【0010】次に本発明に於いては、高温での強度維持を目的とした無機結合材を必要に応じて1～20wt%の範囲で使用することができる。この無機結合材としては、コロイダルシリカ、合成マイカ、モンモリロナイト等が挙げられ、使用方法としては原料中に混合するか、もしくは得られた断熱材へ含浸して使用する。前記無機結合材は1%未満では、得られた断熱材の強度が不足するし、20wt%より多いと、結合材同士の結合力により断熱材の中で偏析してしまう結果、他の部分に粗大な

空隙が生じる為、断熱材の熱伝導率が悪化してしまう。

【0011】さて、上述のような配合割合で配合した組成物を乾式プレス法もしくは湿式抄造法にて任意の形状に成形したものは、嵩密度が0．30～0．50g／cm^3の範囲内にある。この嵩密度が0．30g／cm^3未満では、対流及び分子伝熱が増大し、一方0．50g／cm^3 を超えると固体伝熱が増大するため熱伝導率が著しく低下してしまう。

【0012】以上の断熱壁の構成に於いて、その高温側に配する断熱材の厚みは、自動車排気ガス浄化触媒の外皮温度と、触媒ユニットの最外周（一般的には金属ケース）における目的の温度によって決めればよい。即ち、前記断熱材は、高温に於ける輻射熱を散乱させる事が目的であるから、より高温側に於いてその効果が発揮されるよう望ましくは400℃前後以上の温度領域で使用される。次に本発明の断熱材の製造方法について説明する。

【0013】本発明に於いて前記断熱材は乾式プレス法もしくは湿式抄造法にて製造される。まず最初に乾式プレス法では、前記セラミック系無機繊維、無機粉体及び必要に応じて無機結合材をV型混合機等で混合した後、所定の型内に混合物を投入し、プレスすることにより成形体を得る。尚、得られた成形体に無機結合材を含浸することも可能である。次に、湿式抄造法では、前記セラミック系無機繊維、無機粉体及び必要に応じて無機結合材を水中で分散させ、その後ごく少量の硫酸アルミニウム水溶液や高分子凝集剤を添加し、繊維に無機粉体や無機結合材を添着させる。次に上記凝集体を所定の型内へ投入し、抄紙することにより成形体を得る。得られた成形体を脱水プレスし、シート内の含水率を100%以下に調整した後、乾燥することにより目的とする断熱材が得られる。ここで、脱水プレス後のシート含水率は100%以下にする必要があり、この含水率が100%以上では、乾燥時に収縮が起こり所定の寸法が得られにくくなる。

【0014】上記のようにして得られた断熱材では、セラミック系無機繊維により強度を補強し、さらに無機結合材を使用した場合には高温時の強度が維持される。又、前述の条件に適した二種類の無機粉体を使用することで、断熱材内部に存在する空隙での空気の対流と分子伝熱が抑制され、さらに輻射熱が散乱されるため、その断熱性については従来の物より優れた特性が得られる。さらに、本発明の断熱材は、有機バインダー等を含まないので、加熱後前記有機物が焼失し、空隙が生じる事がない為、従来に比べ低温から高温迄極めて優れた断熱性が得られる。次に、断熱壁の構成に於いてその低温側に配される1種または2種以上の断熱材について説明する。

【0015】無機繊維としては、シリカ－アルミナ繊維、アルミナ繊維、シリカ繊維等はもちろんだが、低温

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度領域で使用される為、ガラスウール、ロックウール等の耐熱性の低い繊維も使用可能である。しかしながら、万一の異常高温を考えシリカ－アルミナ繊維が望ましい。本発明に於いて、断熱材の構造を多層構造とする事の理由の一つは、輻射が支配的となる高温側に於いて、輻射散乱材を用いた低熱伝導率の断熱材を用い、対流及び伝導が支配的となる低温側に於いては、断熱性能の高い比較的空気をよく含んだ主として無機繊維からなる断熱材を用いることにあるが、もう一つの理由として、前記高温側に用いられる断熱材は先に述べたように無機結合材を含むが有機結合材を含まない為極めて圧縮性に乏しい。

【００１６】通常、自動車排気ガス浄化触媒ユニットは、コーデェライト等のセラミック触媒担体または２０Ｃｒ－５Ａｌからなるステンレス触媒担体を金属ケース内に収めて使用される。前記異なる部品には、夫々寸法公差がある為、本発明のような断熱材の入るスペース（クリアランス）は必ずしも一定でない事、また自動車排気系部品は、極寒地での駐車から酷暑地での高速走行等極めて広い温度範囲の条件下で使用される。このような温度範囲の条件下に於いては、触媒担体と金属ケースが異なった膨張収縮を繰り返す。特に熱膨張係数の極めて小さいコーディエライト触媒担体を金属ケース内に収めた場合等、著しいクリアランスの変化が生じる。

【００１７】従って、自動車用排ガス触媒用断熱材には、耐熱及び断熱性のみならず、前記部品組付時の寸法公差及び使用時のクリアランス変動に追従できるような圧縮－復元性が必要である。即ち、高温下での断熱性能に優れるが極めて圧縮性に乏しい断熱材を単体で用いた場合、部品組付時断熱材が破損したり、ケースが変形するばかりでなく、使用時クリアランスが広がった場合、断熱材が振動し破損してしまう。従って、本発明のように圧縮－復元性の高い断熱材との多層構造が必要であり、発明者らは常温に於ける５０％圧縮荷重が１Ｋｇｆ／ｃｍ^2 以下の断熱材を使用すれば、前記のような問題が生じない事を発明した。

【００１８】望ましくは、０．２～０．５Ｋｇｆ／ｃｍ^2 の断熱材と併用する。低温側に用いられる断熱材の厚みは、断熱効果を考えれば、その使用温度範囲が４００℃未満となるようにすればよいが、前記圧縮一復元率の問題から、自動車排気ガス浄化触媒に組みつけられた状態で１ｍｍ以上の厚みを有する事が望ましい。また、構成材料は１種または２種以上が可能であり、使用時のコストを考え、例えばより高温側にシリカ－アルミナ繊維を用いた低温側に低コストのガラスマットを組み合わせた三層構造としてもよいし、より苛酷な振動等の条件下では、シリカ－アルミナ繊維と、シリカクロス等の構成でもよい。

【００１９】上記のようにして得られた自動車排気ガス浄化触媒断熱材では、輻射熱が支配的となる高温下領域

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に於いて強度、断熱性に優れ、伝導、対流が支配的となる低温下領域に於いても強度、断熱性にずくれるばかりでなく、触媒ユニット組付け時には、常温での５０％圧縮荷重が１Ｋｇｆ／ｃｍ^2 以下という極めて圧縮率による復元代も大きい為、耐久性に優れた断熱材が得られる。次に本発明を具体化した実施例及び比較例を以下に説明する。

【００２０】

【実施例】

（実施例１）水５０リットルにシリカ－アルミナ系セラミックファイバーとしていわゆるバルク（イビデン株式会社製：商品名イビウール）を重量比で５部、次に平均屈折率が２．７１であり、平均粒子径が３．５μｍのＴｉO_2 粉体を７０部と、平均屈折率が１．５５であり、平均粒子径が７．０μｍのＳｉO_2 粉体を２０部、更にコロイダルシリカ（日産化学株式会社製：商品名スノーテックス）を固形分重量比で５部添加し、よく撹拌混合した後、ごく少量のカチオン系高分子凝集剤を添加し、スラリーを調整した。次に、前記スラリーを所定の金型にて半割スリーブ状に成形した後乾燥し、厚さ７ｍｍ、嵩密度０．４０ｇ／ｃｍ^3 の断熱材を得た。

【００２１】更にシリカ、アルミナ繊維のブランケット（イビデン株式会社製：商品名イビウール・ソリッドブランケット）厚み６ｍｍ，嵩密度０．１０ｇ／ｃｍ、５０％圧縮荷重０．３Ｋｇｆ／ｃｍ^2 を所定の展開形状に打ち抜き、前記断熱材と貼り合わせたものを２ケ作成した。この２層構造断熱材を円筒形のメタル触媒担体につけたのち、組付後のクリアランスが９．５ｍｍとなるよう半割の金属ケースで覆った。この自動車排気ガス浄化触媒ユニットの組付性は、極めて良好であった。更にこのユニットを実際のガソリン車に搭載し、断熱材の最内層温度が９００℃となるよう排気温度を調整し、最外層となる金属ケースの外側の温度を測定したら２５０℃であった。

【００２２】また、前記ユニットを車に搭載した状態で、６００ｒｐｍ－５分間、５０００ｒｐｍ－５分間を１サイクルとした簡易耐久テストを１０００サイクル実施した後、分析してみたが、断熱材及び触媒担体に何ら損傷はなかった。

【００２３】（比較例１）実施例１と同様の触媒ユニットに断熱材としてシリカ－アルミナ繊維ブランケット厚み１２．５ｍｍ、嵩密度０．１３ｇ／ｃｍ^3 、５０％圧縮荷重、０．５Ｋｇｆ／ｃｍ^2 を用いて実施例１と同様の評価をしたところ、組み付け性は問題なかったが、断熱材の最内層温度が９００℃のとき、最外層となる金属ケースの外側の温度は４８０℃であった。

【００２４】（比較例２）実施例１と同様の触媒ユニットに断熱材として実施例１の半割スリーブ状成形体、厚み１０．ｍｍ、嵩密度０．４０ｇ／ｃｍ^3 、５０％圧縮荷重、１．１Ｋｇｆ／ｃｍ^2 の断熱材を組み付けてみた

が、通常の組み付け装置では圧力不足となり、組み付けできず、油圧プレスを用いて組み付けしたところ、触媒担体が変形してしまった。

【００２５】

【発明の効果】従って、本発明によれば従来品ものように高温下での断熱性に劣ることなく、低温から高温の間で極めて優れた断熱特性を発揮するばかりでなく、従来品のように組み付け性や耐久性に問題がなく、予め所定

の形状に成形され作業性も向上する。また、熱伝導率が低い為従来品より厚みを薄くすることができる為、排気系部品を小型化することができる。さらに、本発明によれば、従来の断熱材に対して有機分を殆ど用いない為、熱伝導率の径時変化がないばかりでなく、使用時に有機バインダーの燃焼によるガス等の発生もない為環境を汚染する心配がない。

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(54) HEAT-INSULATING MATERIAL FOR CATALYST

(57)Abstract:

PURPOSE: To obtain the heat-insulating material comprising a multi-layered structure using a heat-insulating material extremely low in heat conductivity and excellent in durability on the high temperature side of a heat insulating wall and using an inorganic fiber heat- insulating material having good heat-insulating property, assembling property and restoring property at low temperatures on the low temperature side of the heat insulating wall without substantially using an organic material, excellent in the heat-insulating property, assembling property and durability, and useful for automotive exhaust gas-cleaning catalysts.

CONSTITUTION: This heat-insulating material for automotive exhaust gas-cleaning catalysts is characterized by comprising a multi-layered structure material using (A) a heat-insulating material on the high heat temperature side of a heat-insulating wall and (B) one kind or more of heat-insulating materials on the low temperature side of the heat-insulating wall, where the heat-insulating material (A) comprises 1-50wt.% of ceramic inorganic fibers having an average fiber diameter of $\leq$10μm, 40-98wt.% of one kind or more of inorganic powdery materials having an average refractive index of $\geq$1.4 and an average particle diameter of $\leq$10μm, and 1-20wt.% of an

inorganic binder, and having a bulk density of 0.30-0.50g/cm3, and the heat-insulating material (B) consists mainly of inorganic fibers having a 50% compression load of ≤1Kgf/cm2 at the ordinary temperature.

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CLAIMS

[Claim(s)]

[Claim 1] In the configuration of an adiabatic wall, the ceramic system inorganic fiber whose diameter of average fiber is 10 micrometers or less to the elevated-temperature side 1 - 50wt%, One sort of inorganic fine particles whose average refractive indexes are 1.4 or more and the mean particle diameter of whose is 10 micrometers or less, or two sorts or more 40 - 98wt%, It

comes to blend an inorganic binding material at a 1 - 20wt% rate, and they are bulk density 0.30 - 0.50 g/cm3. The heat insulator characterized by having is arranged. And 50% compressive load in ordinary temperature which is mainly from an inorganic fiber on the low temperature side of the configuration of said adiabatic wall is 1 Kgf/cm2. Heat insulator for automobile exhaust air gas cleanup catalysts which consists the following heat insulators of one sort or multilayer structure combined two or more sorts.

[Claim 2] The ceramic system inorganic fiber according to claim 1 used for the elevated-temperature side in the configuration containing various whiskers, such as silica-alumina fiber, an alumina fiber, a silica fiber, and a potassium titanate whisker, of an adiabatic wall.

[Claim 3] Inorganic fine particles according to claim 1 whose solid-state thermal conductivity is below 0.06 cal/cm.sec.deg at the time of a room temperature.

[Claim 4] The heat insulator for automobile exhaust air gas cleanup catalysts according to claim 1 aiming at heat insulation and incubation of the ceramic for automobile exhaust air gas cleanups in the application of a heat insulator or a metal catalytic converter.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]
[Description of the Prior Art] Conventionally, that by which the compression equipment was carried out is used between the metal casings used as catalyst support and its outer case in what pierced and processed into the expansion configuration nonwoven fabrics, such as a ceramic fiber blanket (for example, IBIDEN [CO., LTD.] make: trade name eve wool yarn solid blanket) which consists of for example, a glass wool mat or silica-alumina fiber, as a heat insulator by which a specification is carried out to an automobile exhaust air gas cleanup catalyst.

[0002] In recent years, for the improvement of automobile fuel consumption, exhaust gas temperature is rising as compared with the former, what has the more high clarification effectiveness of an exhaust gas clarification catalyst is being further called for out of the movement toward exhaust gas toughening of regulations, and temperature is high further from exhaust gas temperature with the heat of reaction [near the exhaust gas clarification catalyst]. However, on said glass wool mat, since there was the heat-resistant temperature only to 600-800 degrees C, there was a trouble that an erosion and remarkable performance degradation arose, by elevated-temperature-ization of the above-mentioned exhaust gas. Furthermore, since the ceramic AFUI bar blanket which consists of said silica-alumina fiber is excellent in heat-resistant temperature with 1260 degrees C, It is under [of a tooth space which is called the exhaust air

system components of an automobile although heat deterioration like a glass wool mat is not produced and which was restricted very much] setting. Heat insulation thickness cannot be simply increased to elevated-temperature-izing of the above-mentioned exhaust gas temperature. The outer case temperature of an exhaust gas clarification catalyst becomes high. It not only damages the hose of surrounding electronic parts or a rubber system according to heat damage, but When combustibles, such as dry grass and a corrugated fiberboard, were in the car-body lower part of an automobile at the time of the stop after transit, there was a trouble that there was anxiety, like a fire arises according to heat damage.

[0003] this invention persons set to Japanese Patent Application No. No. 22119 [four to]. A ceramic system inorganic fiber On the other hand, 5 - 50wt%, It comes to blend an inorganic binding material the 3 - 5wt% and organic elastic matter at a 3 - 10wt% rate for inorganic fine particles if needed [50-95wt%], and they are bulk density 0.35 - 0.45 g/cm3. By being characterized by having The heat insulator which made adiathermic and thermal resistance improve by leaps and bounds than the conventional heat insulator was invented.

[0004]
[Problem(s) to be Solved by the Invention] However, the above-mentioned conventional heat insulator contains the organic elastic matter at a 3 - 10wt% rate for the workability improvement at the time of constructing for an automobile exhaust air gas cleanup catalyst. Since the part in which the organic elastic matter was burned down in **** at the time of this heat insulator activity (when the engine of an automobile is started actually), the organic elastic matter was burned down in heating and coincidence at the time of a heat insulator activity the offensive odor by combustion gas not only leaves and puts, but, and the organic elastic matter after destruction by fire existed becomes an opening, dispersion of radiant heat and a screening effect fell and it reached especially the conclusion that adiathermic is inadequate, under the temperature of 350 degrees C or more. Then, the object of this invention can fabricate a heat insulator according to the configuration of an activity part, moreover, raises adiathermic from elegance conventionally, and is to offer the heat insulator for automobile exhaust air gas cleanup catalysts which made compression assembliability improve further.

[0005]
[Means for Solving the Problem and its Function] In the configuration of an adiabatic wall, the ceramic system inorganic fiber whose diameter of average fiber is 10 micrometers or less to the elevated-temperature side 1 - 50wt%, One sort of inorganic fine particles whose average refractive indexes are 1.4 or more and the mean particle diameter of whose is 10 micrometers or less, or two sorts or more 40 - 98wt%, It comes to blend an inorganic binding material at a 1 - 20wt% rate, and they are bulk density 0.30 - 0.50 g/cm3. The heat insulator characterized by having is arranged. And 50% compressive load in ordinary temperature which is mainly from an inorganic fiber on the low temperature side of the configuration of said adiabatic wall is 1 Kgf/cm2. Heat insulator for automobile exhaust air gas cleanup catalysts which consists the following heat insulators of one sort or multilayer structure combined two or more sorts.

[0006]
[Function] Next, the configuration of this invention is explained to a detail. First, in the configuration of an adiabatic wall, the heat insulator arranged on the elevated-temperature side is

explained. As a ceramic system inorganic fiber, various whiskers, such as silica-alumina fiber, an alumina fiber, a silica fiber, a SiC whisker, and a potassium titanate whisker, can be used. The range of the loadings of this ceramic system inorganic fiber is 1 - 50wt%, less than [1wt%], the reinforcement effectiveness of fiber will not be acquired for this rate, but handling nature and a mechanical strength will fall remarkably.

[0007] On the other hand, since the addition of inorganic fine particles decreases and convective heat transfer, molecule heat transfer, radiation conduction, etc. will increase if 50wt% is exceeded, a heat insulation property will fall remarkably. Moreover, the diameter of average fiber of said inorganic fiber needs to be 10 micrometers or less. It is because the opening between fiber will become large, a big and rough opening will be generated in the obtained heat insulator and it will generally become easy to spread radiant heat, if its diameter of average fiber is larger than 10 micrometers, since an inorganic fiber is stiffness.

[0008] the inorganic fine particles which suit the conditions shown below in this invention -- a kind -- or two or more kinds are used, choosing.
(1) An average refractive index is 1.4 or more.
(2) Mean particle diameter is 10 micrometers or less.
(3) As 1.4 or more fine particles, although TiO2, BaTiO3, PbS, etc. are mentioned, the average refractive index whose solid-state thermal conductivity is below 0.06 cal/cm.sec.deg at the time of a room temperature In order for this group's inorganic fine particles to have the role very important as dispersion material of radiant heat and to scatter radiant heat more effectively A refractive index is large as much as possible, and it is desirable to use the inorganic fine particles which have the peak whose reflection factor to light with a wavelength of 10 micrometers or more is moreover 70% or more. Therefore, it sets to this invention and is TiO2 of rutile type structure. It decided to use.

[0009] Moreover, the solid-state thermal conductivity in which mean particle diameter is within the limits of 10 micrometers or less, and each fine particles moreover have the inorganic fine particles used in this invention is limited to the object which is below 0.06 cal/cm.sec.deg (at room temperature). Since the hole which it will produce in a heat insulator if mean particle diameter uses fine particles 10 micrometers or more becomes very large, the convection current and molecule heat transfer will increase, and thermal conductivity will get worse. And if the fine particles more than 0.06 cal/cm.sec.deg (at room temperature) are used also about solid-state thermal conductivity, solid-state heat transfer will become dominant into a heat insulator, and thermal conductivity will get worse. Therefore, a kind or two kinds of inorganic fine particles which suited three conditions indicated to the above-mentioned in this invention are used, and the blending ratio of coal is taken as the range of 40 - 98wt%. Since the blending ratio of coal of the amount of refractive-index size of fine particles of inorganic fine particles decreases less than [40wt%], it will become inadequate being scattered [of radiant heat] about and the thermal conductivity under an elevated temperature 300 degrees C or more will get worse. Moreover, more than at 98wt%, although it is advantageous in respect of thermal conductivity, the blending ratio of coal, such as a ceramic system inorganic fiber, will become less than [2wt%], and reinforcement will fall remarkably.

[0010] Next, in this invention, an inorganic binding material aiming at the maintenance on the strength in an elevated temperature can be used in 1 - 20wt% if needed. It is sunk in and used to the heat insulator which colloidal silica, synthetic mica, a montmorillonite, etc. were mentioned, and was mixed in the raw material as operation as this inorganic binding material, or was obtained. Said inorganic binding material runs short of the reinforcement of the obtained heat insulator at less than 1%, and since a big and rough opening will be generated into other parts as a result of segregating in a heat insulator according to the bonding strength of binding material if [than 20wt%] more, the thermal conductivity of a heat insulator will get worse.

[0011] Now, some which fabricated the constituent blended by the above blending ratio of coal in the configuration of arbitration by the dry type pressing method or the wet milling-paper method have bulk density within the limits of 0.30 - 0.50 g/cm3. This bulk density is 0.30 g/cm3. In the following, the convection current and molecule heat transfer increase, and, on the other hand, they are 0.50 g/cm3. Since solid-state heat transfer will increase if it exceeds, thermal conductivity will fall remarkably.

[0012] What is necessary is just to decide the thickness of the heat insulator arranged on the elevated-temperature side in the configuration of the above adiabatic wall with the envelope temperature of an automobile exhaust air gas cleanup catalyst, and temperature to be able to set to the outermost periphery (generally metal casing) of a catalytic unit. That is, since it is the object to scatter hot radiant heat, said heat insulator is desirably used in the temperature field more than around 400 degrees C so that the effectiveness may be demonstrated more at an elevated-temperature side. Next, the manufacture approach of the heat insulator of this invention is explained.

[0013] In this invention, said heat insulator is manufactured by the dry type pressing method or the wet milling-paper method. First, by the dry type pressing method, after mixing an inorganic binding material by a V shaped rotary mixer etc. said ceramic system inorganic fiber, inorganic fine particles, and if needed, a Plastic solid is acquired by throwing in mixture and pressing in a predetermined mold. In addition, it is also possible to sink an inorganic binding material into the acquired Plastic solid. Next, an inorganic binding material is distributed underwater said ceramic system inorganic fiber, inorganic fine particles, and if needed, after that very little aluminum-sulfate water solution and polymer coagulant are added, and fiber is made to install inorganic fine particles and an inorganic binding material by the wet milling-paper method. Next, a Plastic solid is acquired by supplying the above-mentioned floc into a predetermined mold, and carrying out paper making. After carrying out the dehydrating press of the acquired Plastic solid and adjusting the water content in a sheet to 100% or less, the target heat insulator is obtained by drying. Here, it is necessary to make sheet water content behind the dehydrating press 100% or less, and at 100% or more, contraction takes place [this water content] at the time of desiccation, and a predetermined dimension becomes is hard to be obtained.

[0014] In the heat insulator obtained as mentioned above, reinforcement is reinforced by the ceramic system inorganic fiber, and when an inorganic binding material is used further, the reinforcement at the time of an elevated temperature is maintained. Moreover, since the convection current and molecule heat transfer of air in an opening which exist in the interior of a heat insulator are controlled and radiant heat is further scattered about by using two kinds of

inorganic fine particles suitable for the above-mentioned conditions, the property superior to the conventional object is acquired about adiathermic [the]. Furthermore, since the heat insulator of this invention does not contain an organic binder etc., the heating backward aforementioned organic substance is burned down and an opening is not generated, adiathermic [which was extremely excellent to low warm elevated temperatures compared with the former] is acquired. Next, one sort or two sorts or more of heat insulators arranged on the low temperature side in the configuration of an adiabatic wall are explained.

[0015] As an inorganic fiber, although silica-alumina fiber, the alumina fiber, the silica fiber, etc. are natural, since it is used in a low temperature field, heat-resistant low fiber, such as glass wool and rock wool, is also usable. However, an emergency abnormality elevated temperature is considered and silica-alumina fiber is desirable. In this invention, one of the reasons of making structure of a heat insulator into multilayer structure Although it is in using the heat insulator with high heat insulation property which included air well comparatively and which mainly consists of an inorganic fiber for the low temperature side from which it becomes dominant using the heat insulator of low thermal conductivity using radiation dispersion material the convection current and conducting radiation in the elevated-temperature side which becomes dominant As another reason, although the heat insulator used for said elevated-temperature side contains an inorganic binding material as stated previously, since it does not contain an organic binding material, it is very lacking in compressibility.

[0016] Usually, it is used for the stainless steel catalyst support which consists of ceramic catalyst support, such as a KODEE light, or 20Cr(s)-5aluminum by the automobile exhaust air gas cleanup catalytic unit in metal casing, storing. Since there is a dimensional tolerance, respectively, the tooth space (path clearance) containing a heat insulator like this invention not being necessarily fixed and automobile exhaust air system components are used for said different component from parking in the arctic ground under conditions of a very large temperature requirement, such as high-speed transit in the intense-heat ground. The expansion contraction from which catalyst support and metal casing differed under the condition of such a temperature requirement is repeated. When especially the very small cordierite catalyst support of a coefficient of thermal expansion is stored in metal casing, a remarkable change of path clearance arises.

[0017] Therefore, a heatproof and not only adiathermic but the compression-stability which can follow the dimensional tolerance at the time of with [said] a components group and the path clearance fluctuation at the time of an activity is required for the heat insulator for exhaust gas catalysts for automobiles. That is, a heat insulator will be vibrated and damaged when a heat insulator is damaged at the time of with a components group when a heat insulator very lacking in compressibility is used alone, although excelled in the heat insulation property under an elevated temperature, or a case not only deforms, but path clearance spreads at the time of an activity. Therefore, 50% compressive load [in / multilayer structure with the high heat insulator of compression-stability is required like this invention, and / in artificers / ordinary temperature] is 1 Kgf/cm2. When using the following heat insulators, it invented that the above problems did not arise.

[0018] Desirably, it is 0.2 - 0.5 Kgf/cm2. It uses together with a heat insulator. Although what is necessary is just to make it considering adiabatic efficiency the operating temperature limits become less than 400 degrees C, as for the thickness of the heat insulator used for a low temperature side, it is desirable to have the thickness of 1mm or more from the problem of said compression 1 recovery, after having been constructed by the automobile exhaust air gas cleanup catalyst. Moreover, one sort or two sorts or more of the component may be possible, it may be good also as three layer systems which combined the fiberglass mat of low cost with the low temperature side which considered the cost at the time of an activity, for example, used silica-alumina fiber for the elevated-temperature side more, and silica-alumina fiber and the configuration of a silica cross etc. are sufficient as it under conditions, such as a crueller oscillation.

[0019] Even if it sets to the bottom field of low temperature to which it excels in reinforcement and adiathermic in the bottom field of an elevated temperature to which radiant heat becomes dominant, and conduction and the convection current become dominant in the automobile exhaust air gas cleanup catalyst heat insulator obtained as mentioned above, not only at ******** but at the time of catalytic-unit assembly, 50% compressive load in ordinary temperature is 1 Kgf/cm2 to reinforcement and adiathermic. Since restoration cost called the following according to compressibility very much is also large, the heat insulator excellent in endurance is obtained. Next, the example and the example of a comparison which materialized this invention are explained below.

[0020]
[Example]
The so-called bulk (IBIDEN [CO., LTD.] make: trade name eve wool yarn) by the weight ratio as silica-alumina system ceramic fiber in 50l. of water The five sections, (Example 1) Next, TiO2 whose average refractive index is 2.71 and whose mean particle diameter is 3.5 micrometers Fine particles The 70 sections, SiO2 whose average refractive index is 1.55 and whose mean particle diameter is 7.0 micrometers Fine particles The 20 sections, Furthermore, after adding the 5 sections (the Nissan chemistry incorporated company make: trade name Snow tex) of colloidal silica by the solid content weight ratio and improving stirring mixing, the very little cation system polymer coagulant was added, and the slurry was adjusted. Next, it dries, after fabricating said slurry with predetermined metal mold in the shape of a half-segmented sleeve, and they are 7mm in thickness, and bulk density 0.40 g/cm3. The heat insulator was obtained.

[0021] Furthermore, a silica, the blanket (IBIDEN [CO., LTD.] make: trade name eve wool yarn solid blanket) thickness of 6mm of an alumina fiber, bulk density 0.10 g/cm, and 50% compressive-load 0.3 Kgf/cm2 It pierced in the predetermined expansion configuration and said heat insulator and two stuck things were created. After attaching this two-layer structure heat insulator to the metal catalyst support of a cylindrical shape, it covered with half-segmented metal casing so that the path clearance of the back with a group might be set to 9.5mm. The assembliability of this automobile exhaust air gas cleanup catalytic unit was very good. Furthermore, when measuring the temperature of the outside of the metal casing which carries this unit in a actual gasoline-powered vehicle, adjusts an exhaust-gas temperature so that the innermost layer temperature of a heat insulator may become 900 degrees C, and serves as an

outermost layer of drum, it was 250 degrees C.

[0022] Moreover, although it analyzed after carrying out 1000 cycles of simple torture tests which made 1 cycle for [600rpm-] 5 minutes and for [5000rpm-] 5 minutes, where said unit is carried in a vehicle, there was no breakage in a heat insulator and catalyst support in any way.

[0023] (Example 1 of a comparison) the same catalytic unit as an example 1 -- as a heat insulator -- the silica-alumina fiber blanket thickness of 12.5mm, bulk density 0.13g/cm3, 50% compressive load, and 0.5 Kgf/cm2 When it used and the same assessment as an example 1 was carried out, attachment nature was satisfactory, but when the innermost layer temperature of a heat insulator was 900 degrees C, the temperature of the outside of the metal casing used as an outermost layer of drum was 480 degrees C.

[0024] (Example 2 of a comparison) the same catalytic unit as an example 1 -- as a heat insulator -- the half-segmented sleeve-like Plastic solid of an example 1, thickness 10.mm, bulk density 0.40 g/cm3, 50% compressive load, and 1.1 Kgf/cm2 Although the heat insulator was attached, with usual attachment equipment, it became insufficient [a pressure], and could not attach and do, but when it attached and carries out using a hydraulic press, catalyst support has deformed.

[0025]
[Effect of the Invention] therefore -- according to this invention -- the conventional article thing -- it not only demonstrates the heat insulation property which was extremely excellent among low warm elevated temperatures, but without being [like] inferior to adiathermic [under an elevated temperature], it attaches like elegance before, there is no problem in a sex or endurance, it is beforehand fabricated by the predetermined configuration, and workability improves. Moreover, since thermal conductivity is low and thickness can be conventionally made thinner than elegance, exhaust air system components can be miniaturized. Furthermore, it is not only changeless at the time of the path of the heat conductivity, but [in order to hardly use a part for organic to the conventional heat insulator,] according to this invention, since there is also no generating of the gas by combustion of an organic binder etc. at the time of an activity, there is no fear of polluting an environment.

PRIOR ART

[Description of the Prior Art] Conventionally, that by which the compression equipment was carried out is used between the metal casings used as catalyst support and its outer case in what pierced and processed into the expansion configuration nonwoven fabrics, such as a ceramic fiber blanket (for example, IBIDEN [CO., LTD.] make: trade name eve wool yarn solid blanket) which consists of for example, a glass wool mat or silica-alumina fiber, as a heat insulator by which a specification is carried out to an automobile exhaust air gas cleanup catalyst.

[0002] In recent years, for the improvement of automobile fuel consumption, exhaust gas temperature is rising as compared with the former, what has the more high clarification effectiveness of an exhaust gas clarification catalyst is being further called for out of the movement toward exhaust gas toughening of regulations, and temperature is high further from exhaust gas temperature with the heat of reaction [near the exhaust gas clarification catalyst]. However, on said glass wool mat, since there was the heat-resistant temperature only to 600-800 degrees C, there was a trouble that an erosion and remarkable performance degradation arose, by elevated-temperature-ization of the above-mentioned exhaust gas. Furthermore, since the ceramic AFUI bar blanket which consists of said silica-alumina fiber is excellent in heat-resistant temperature with 1260 degrees C, It is under [of a tooth space which is called the exhaust air system components of an automobile although heat deterioration like a glass wool mat is not produced and which was restricted very much] setting. Heat insulation thickness cannot be simply increased to elevated-temperature-izing of the above-mentioned exhaust gas temperature. The outer case temperature of an exhaust gas clarification catalyst becomes high. It not only damages the hose of surrounding electronic parts or a rubber system according to heat damage, but When combustibles, such as dry grass and a corrugated fiberboard, were in the car-body lower part of an automobile at the time of the stop after transit, there was a trouble that there was anxiety, like a fire arises according to heat damage.

[0003] this invention persons set to Japanese Patent Application No. No. 22119 [four to]. A ceramic system inorganic fiber On the other hand, 5 - 50wt%, It comes to blend an inorganic binding material the 3 - 5wt% and organic elastic matter at a 3 - 10wt% rate for inorganic fine particles if needed [50-95wt%], and they are bulk density 0.35 - 0.45 g/cm3. By being characterized by having The heat insulator which made adiathermic and thermal resistance improve by leaps and bounds than the conventional heat insulator was invented.

EFFECT OF THE INVENTION

[Effect of the Invention] therefore -- according to this invention -- the conventional article thing -- it not only demonstrates the heat insulation property which was extremely excellent among low warm elevated temperatures, but without being [like] inferior to adiathermic [under an elevated temperature], it attaches like elegance before, there is no problem in a sex or endurance, it is beforehand fabricated by the predetermined configuration, and workability improves. Moreover, since thermal conductivity is low and thickness can be conventionally made thinner than elegance, exhaust air system components can be miniaturized. Furthermore, it is not only changeless at the time of the path of the heat conductivity, but [in order to hardly use a part for organic to the conventional heat insulator,] according to this invention, since there is also no generating of the gas by combustion of an organic binder etc. at the time of an activity, there is no fear of polluting an environment.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the above-mentioned conventional heat insulator contains the organic elastic matter at a 3 - 10wt% rate for the workability improvement at the time of constructing for an automobile exhaust air gas cleanup catalyst. Since the part in which the organic elastic matter was burned down in **** at the time of this heat insulator activity (when the engine of an automobile is started actually), the organic elastic matter was burned down in heating and coincidence at the time of a heat insulator activity the offensive odor by combustion gas not only leaves and puts, but, and the organic elastic matter after destruction by fire existed becomes an opening, dispersion of radiant heat and a screening effect fell and it reached especially the conclusion that adiathermic is inadequate, under the temperature of 350 degrees C or more. Then, the object of this invention can fabricate a heat insulator according to the configuration of an activity part, moreover, raises adiathermic from elegance conventionally, and is to offer the heat insulator for automobile exhaust air gas cleanup catalysts which made compression assembliability improve further.

OPERATION

[Means for Solving the Problem and its Function] In the configuration of an adiabatic wall, the ceramic system inorganic fiber whose diameter of average fiber is 10 micrometers or less to the elevated-temperature side 1 - 50wt%, One sort of inorganic fine particles whose average refractive indexes are 1.4 or more and the mean particle diameter of whose is 10 micrometers or less, or two sorts or more 40 - 98wt%, It comes to blend an inorganic binding material at a 1 - 20wt% rate, and they are bulk density 0.30 - 0.50 g/cm3. The heat insulator characterized by having is arranged. And 50% compressive load in ordinary temperature which is mainly from an inorganic fiber on the low temperature side of the configuration of said adiabatic wall is 1 Kgf/cm2. Heat insulator for automobile exhaust air gas cleanup catalysts which consists the following heat insulators of one sort or multilayer structure combined two or more sorts.

EXAMPLE

[Example]
The so-called bulk (IBIDEN [CO., LTD.] make: trade name eve wool yarn) by the weight ratio as silica-alumina system ceramic fiber in 50l. of water The five sections, (Example 1) Next, TiO2 whose average refractive index is 2.71 and whose mean particle diameter is 3.5 micrometers Fine particles The 70 sections, SiO2 whose average refractive index is 1.55 and whose mean particle diameter is 7.0 micrometers Fine particles The 20 sections, Furthermore,

after adding the 5 sections (the Nissan chemistry incorporated company make: trade name Snow tex) of colloidal silica by the solid content weight ratio and improving stirring mixing, the very little cation system polymer coagulant was added, and the slurry was adjusted. Next, it dries, after fabricating said slurry with predetermined metal mold in the shape of a half-segmented sleeve, and they are 7mm in thickness, and bulk density 0.40 g/cm3. The heat insulator was obtained.

[0021] Furthermore, a silica, the blanket (IBIDEN [CO., LTD.] make: trade name eve wool yarn solid blanket) thickness of 6mm of an alumina fiber, bulk density 0.10 g/cm, and 50% compressive-load 0.3 Kgf/cm2 It pierced in the predetermined expansion configuration and said heat insulator and two stuck things were created. After attaching this two-layer structure heat insulator to the metal catalyst support of a cylindrical shape, it covered with half-segmented metal casing so that the path clearance of the back with a group might be set to 9.5mm. The assembliability of this automobile exhaust air gas cleanup catalytic unit was very good. Furthermore, when measuring the temperature of the outside of the metal casing which carries this unit in a actual gasoline-powered vehicle, adjusts an exhaust-gas temperature so that the innermost layer temperature of a heat insulator may become 900 degrees C, and serves as an outermost layer of drum, it was 250 degrees C.

[0022] Moreover, although it analyzed after carrying out 1000 cycles of simple torture tests which made 1 cycle for [600rpm-] 5 minutes and for [5000rpm-] 5 minutes, where said unit is carried in a vehicle, there was no breakage in a heat insulator and catalyst support in any way.

[0023] (Example 1 of a comparison) the same catalytic unit as an example 1 -- as a heat insulator -- the silica-alumina fiber blanket thickness of 12.5mm, bulk density 0.13g/cm3, 50% compressive load, and 0.5 Kgf/cm2 When it used and the same assessment as an example 1 was carried out, attachment nature was satisfactory, but when the innermost layer temperature of a heat insulator was 900 degrees C, the temperature of the outside of the metal casing used as an outermost layer of drum was 480 degrees C.

[0024] (Example 2 of a comparison) the same catalytic unit as an example 1 -- as a heat insulator -- the half-segmented sleeve-like Plastic solid of an example 1, thickness 10.mm, bulk density 0.40 g/cm3, 50% compressive load, and 1.1 Kgf/cm2 Although the heat insulator was attached, with usual attachment equipment, it became insufficient [a pressure], and could not attach and do, but when it attached and carries out using a hydraulic press, catalyst support has deformed.